Electrofuels via Microbial Electrosynthesis

"The shortest path from the sun to fuel"

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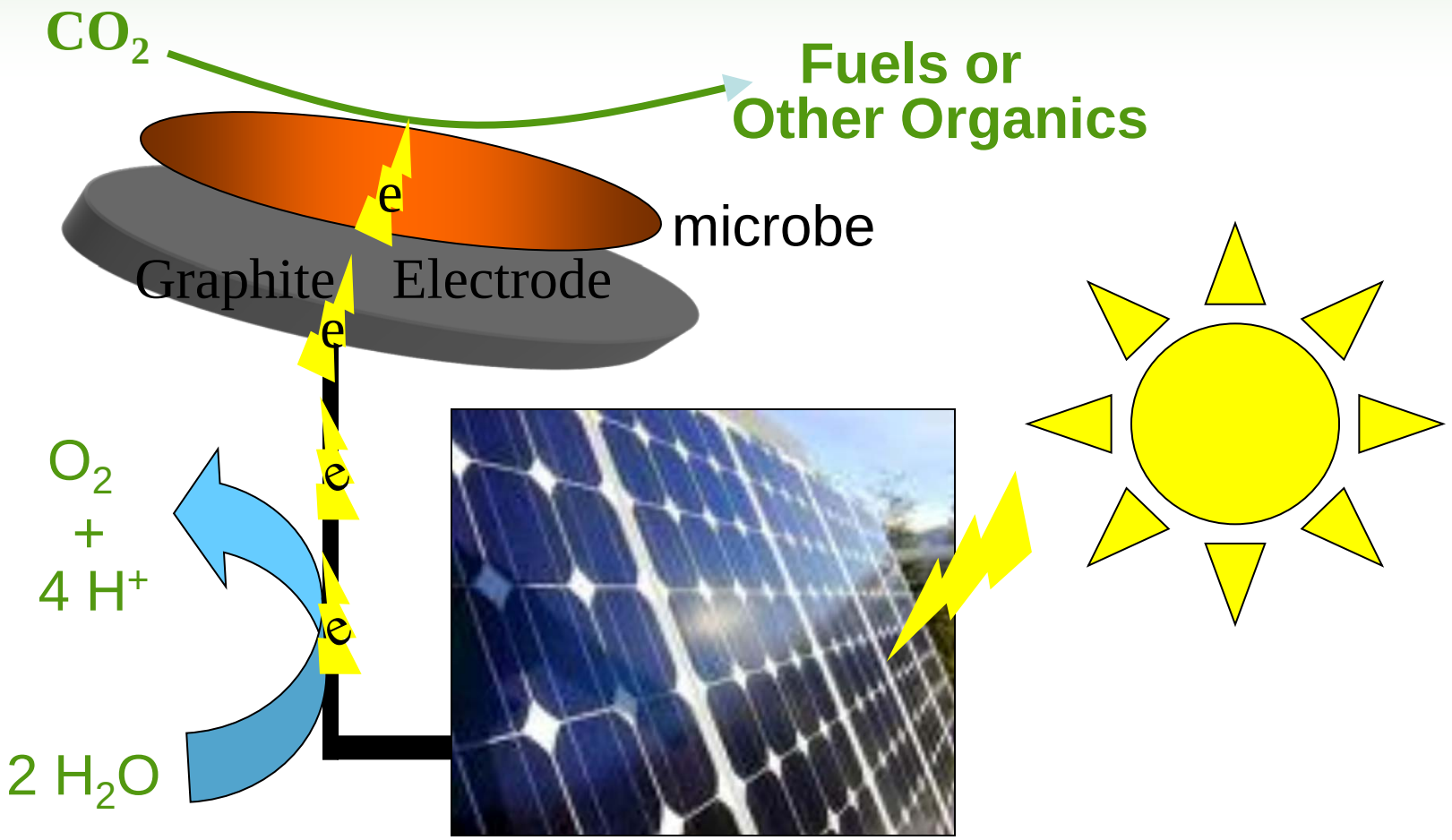
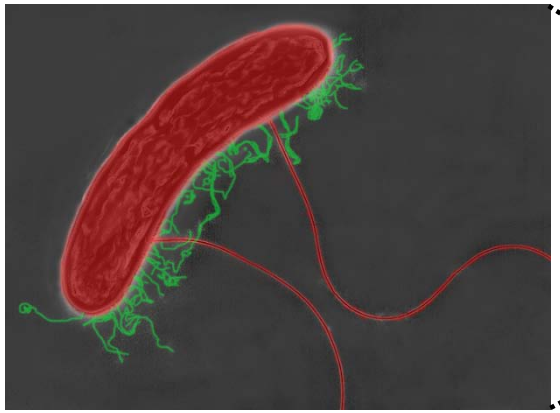
Microbial Electrosynthesis (Me^{-}) Concept

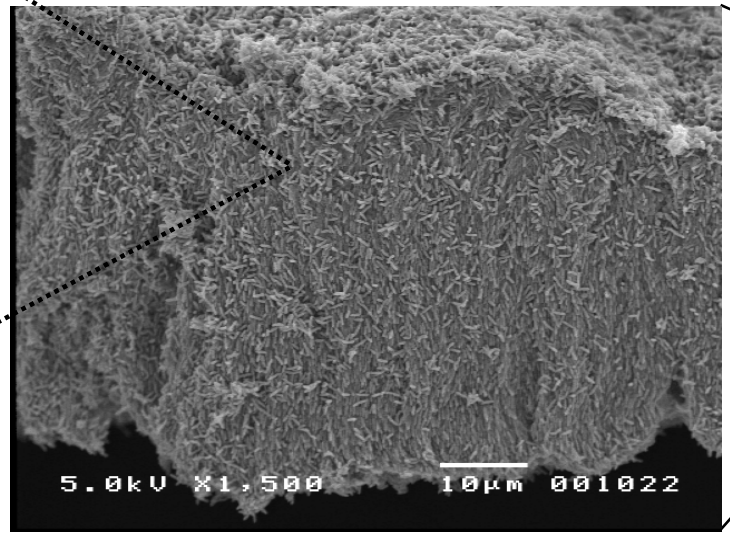


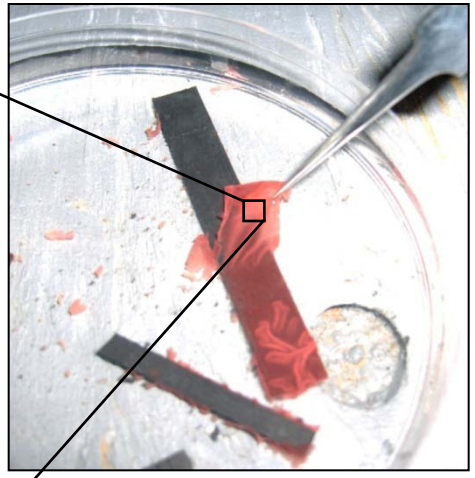
Nevin, K. P., T. L. Woodard, A. E. Franks, Z. M. Summers, and D. R. Lovley. 2010. Microbial electrosynthesis: feeding microbes electricity to convert carbon dioxide and water to multicarbon extracellular organic compounds. mBio 1:doi: 10.1128/ mBio.00103-10

Conductive Biofilms

Microbial Electrosynthesis Exploits the Ability of Some Microbes to Make Electrical Contacts with Electrodes and Other Cells

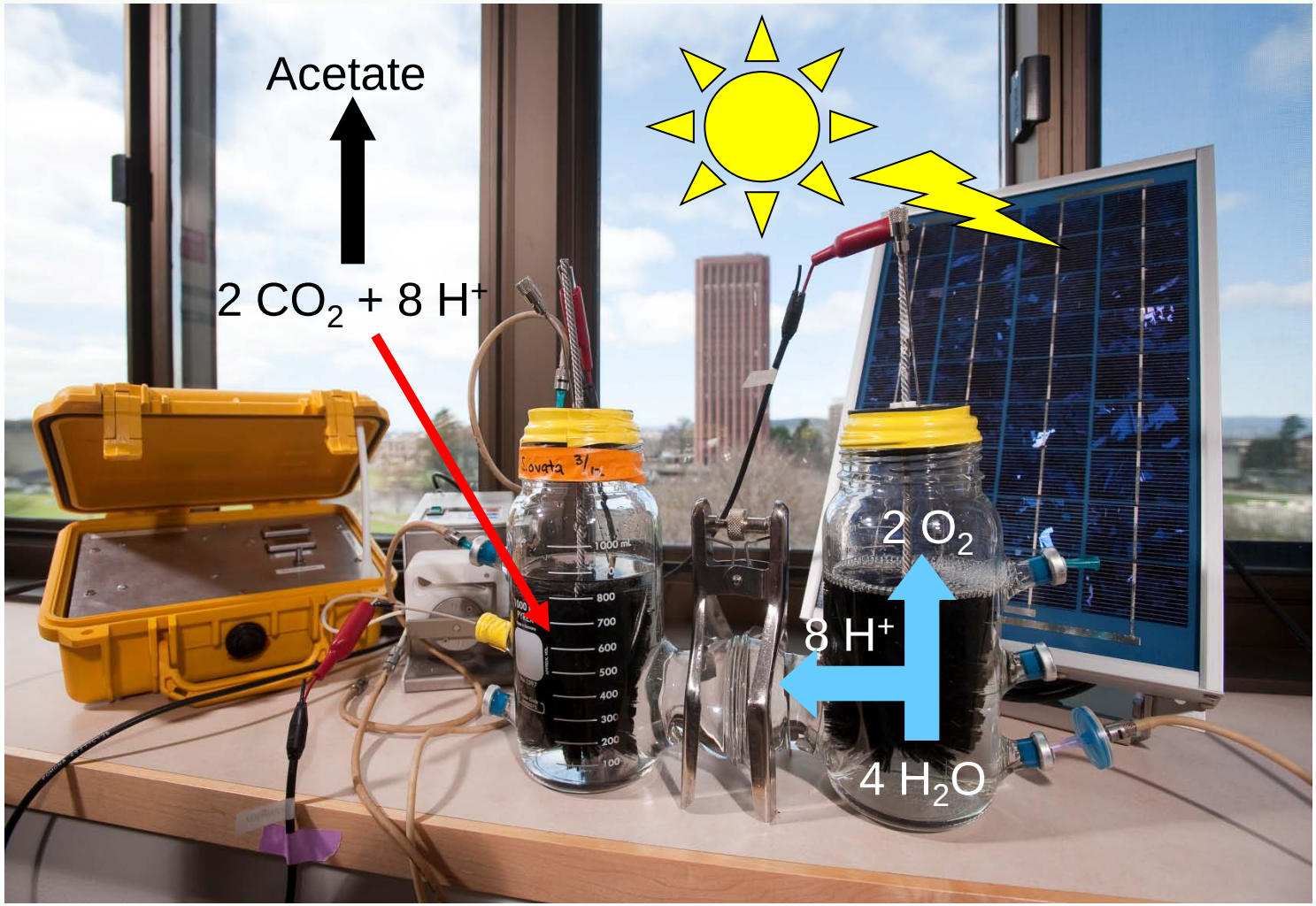




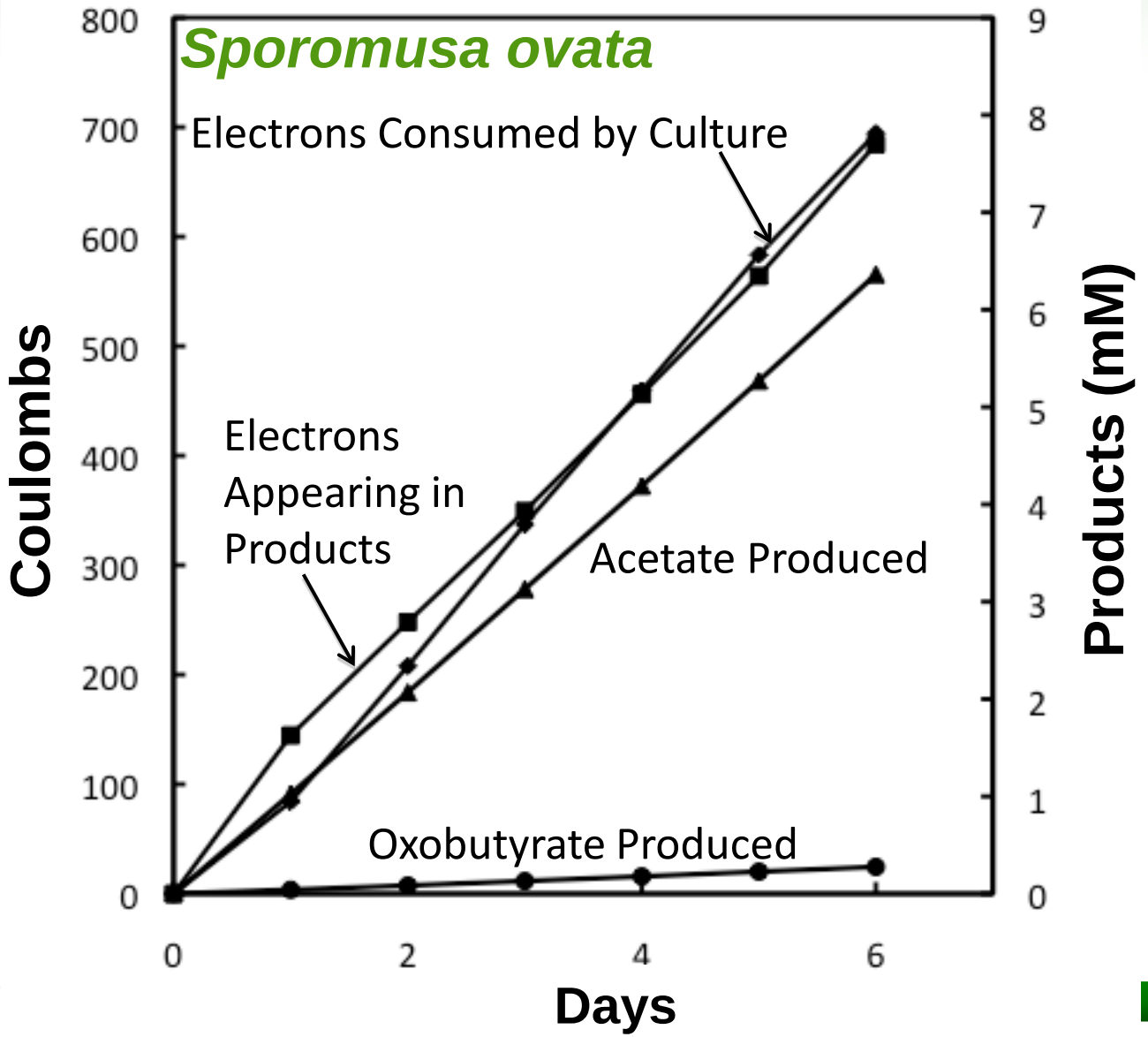


Bond, D. R., D. E. Holmes, L. M. Tender, and D. R. Lovley. 2002. Science 295:483-5.
Reguera, G., K. D. McCarthy, T. Mehta, J. S. Nicoll, M. T. Tuominen, and D. R. Lovley. 2005. Nature 435:1098-1101.
Summers, Z. M., H. Fogarty, C. Leang, A. E. Franks, N. S. Malvankar, and D. R. Lovley. 2010. Science 330:1413-1415.

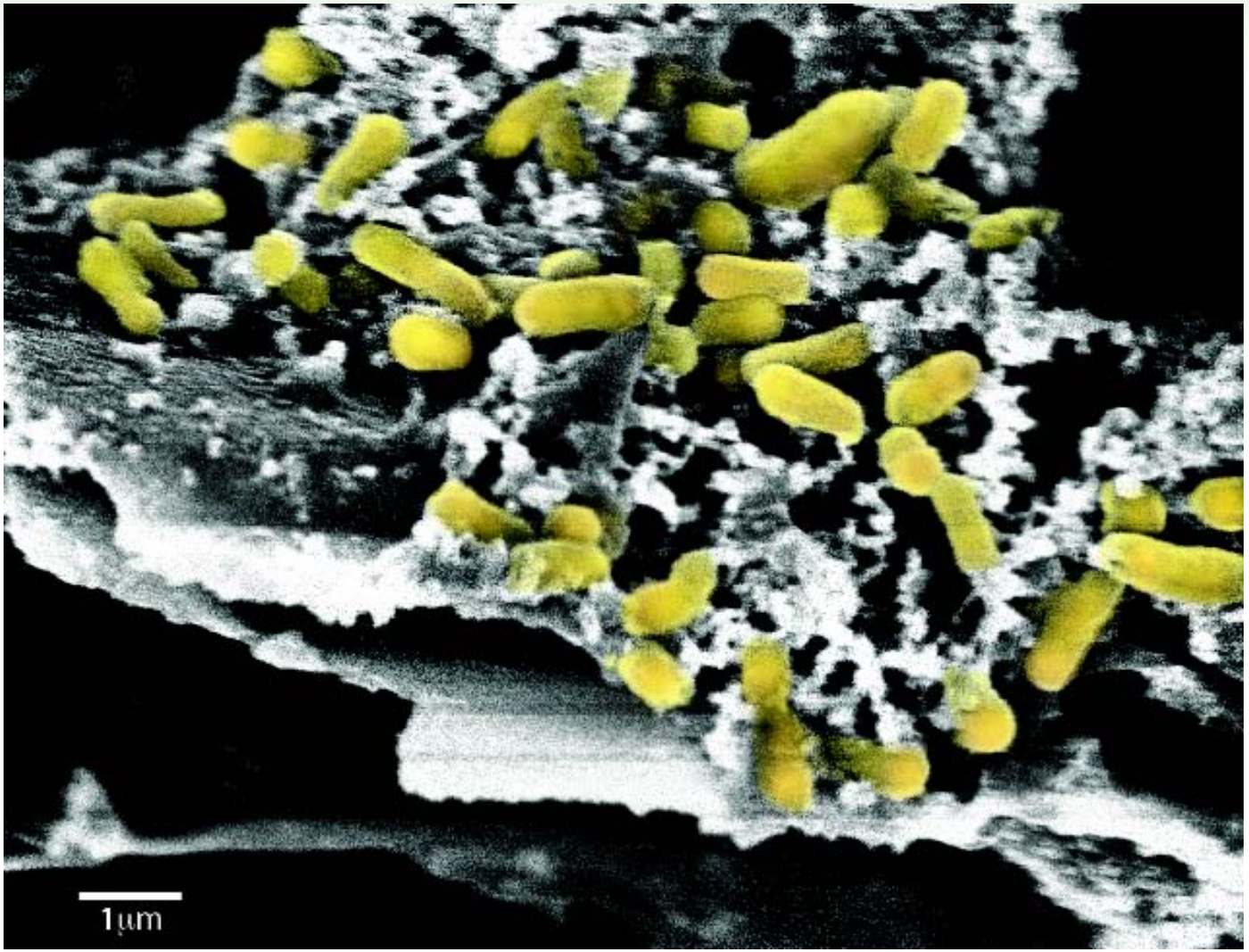
Table-Top Microbial Electrosynthesis Unit



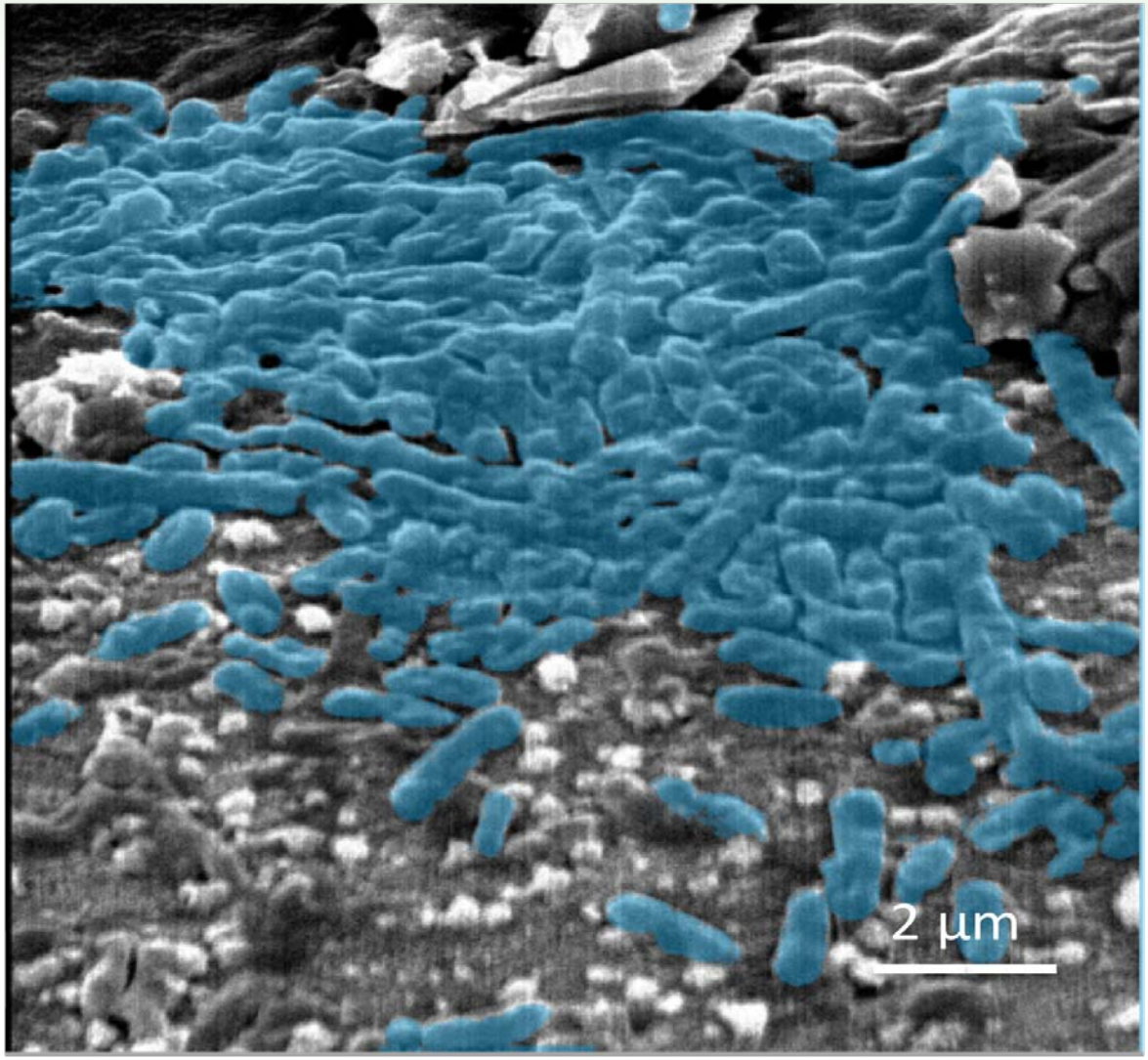
Acetate Production with Microbial Electrosynthesis



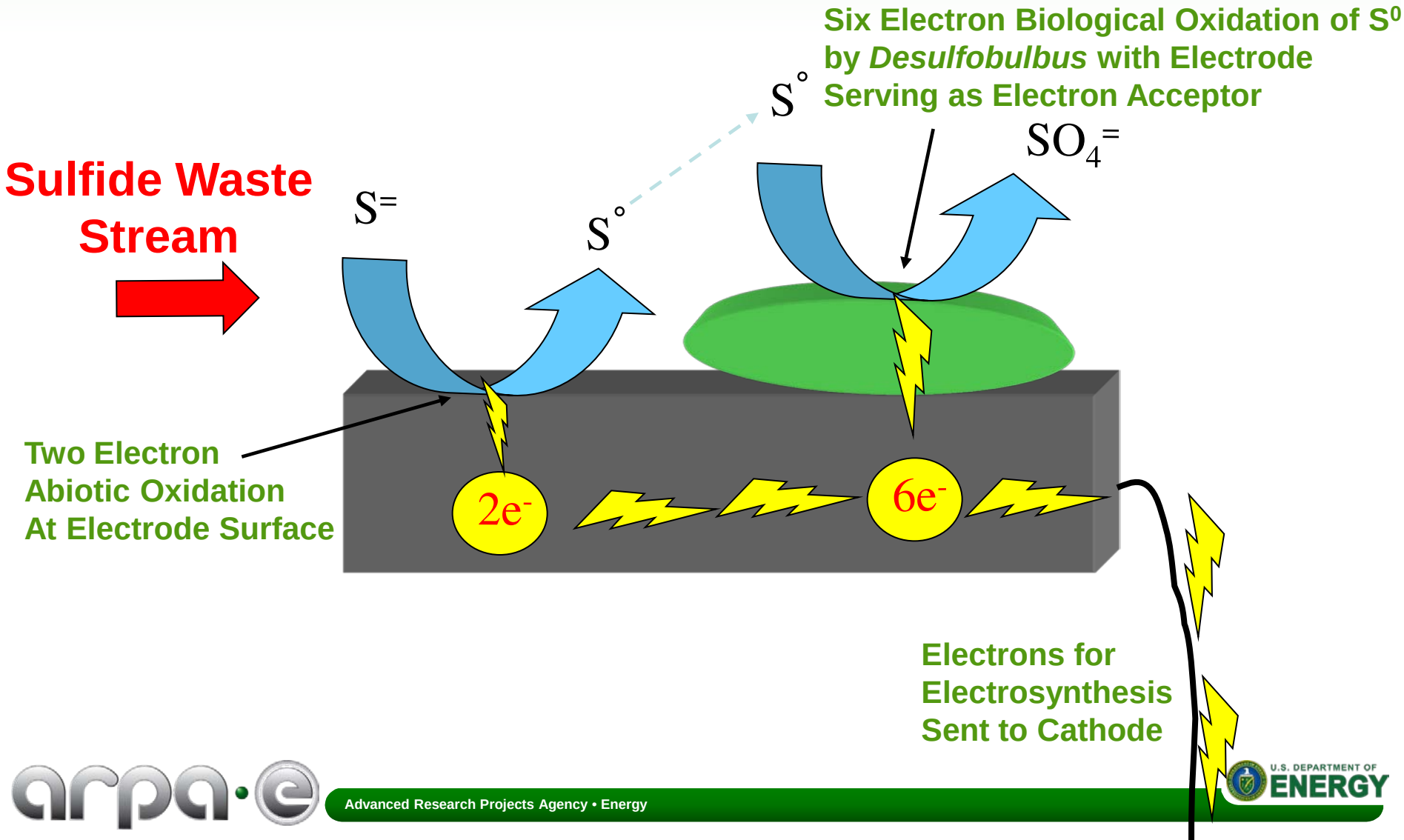
Cells on Electrode Surface



Butanol Production with *Clostridium ljungdahlii*



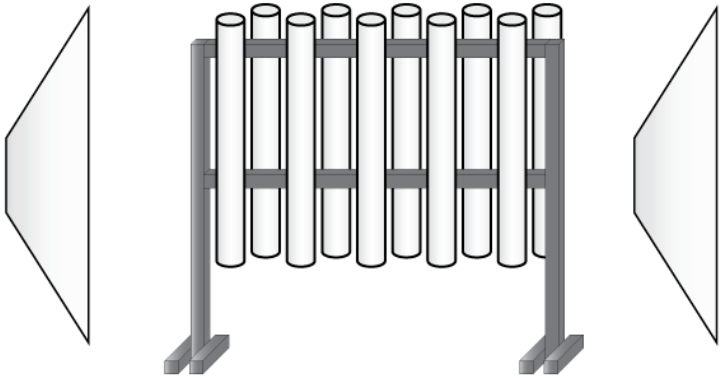
Electrons from Sulfide Waste Streams



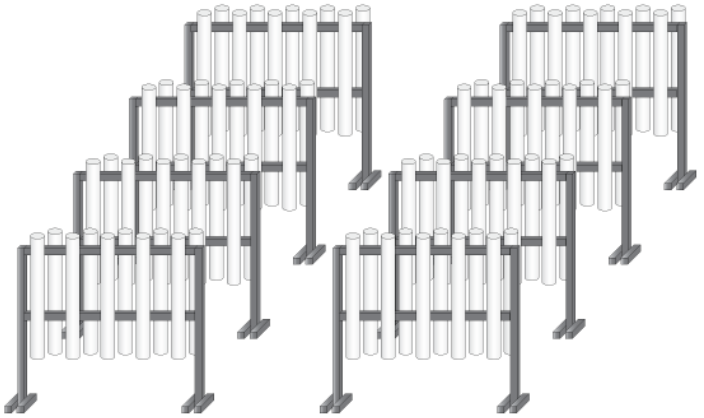
Designing for Large-Scale Production

Single CU

Rack of CUs



Module of Racks



Cost target at scale:
$2.10 / gal BuOH =
$2.30 / gal Gasoline equivalent

Microbial Electrosynthesis Summary

- Microbial electrosynthesis technology has been demonstrated at the laboratory scale.
- Ongoing research and development is focused on:
  - Enhancing acetate production as feedstock for fuel production
  - Optimizing butanol production as strategy for direct fuel production
  - Evaluating sulfide wastes as an alternative source of electrons
  - Optimizing reactor design for large-scale production